SBML Model Report

Model name: "Leber2015 - Mucosal immunity and gut microbiome interaction during C. difficile infection"

May 6, 2016

1 General Overview

This is a document in SBML Level 2 Version 4 format. This model was created by the following two authors: Vijayalakshmi Chelliah[1] and Andrew Leber[2] at April eighth 2014 at 1:02 p. m. and last time modified at August 27th 2015 at 5:07 p. m. Table 1 shows an overview of the quantities of all components of this model.

Table 1: Number of components in this model, which are described in the following sections.

Element	Quantity	Element	Quantity
compartment types	0	compartments	4
species types	0	species	23
events	0	constraints	0
reactions	30	function definitions	11
global parameters	0	unit definitions	3
rules	0	initial assignments	0

Model Notes

Leber2015 - Mucosal immunity and gutmicrobiome interaction during C. difficile infection

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This model is described in the article:Systems Modeling of Interactions between Mucosal Immunity and the Gut Microbiome during Clostridium difficile Infection.Leber A, Viladomiu M, Hontecillas R, Abedi V, Philipson C, Hoops S, Howard B, Bassaganya-Riera J.PLoS ONE 2015; 10(7): e0134849

Abstract:

Clostridium difficile infections are associated with the use of broad-spectrum antibiotics and result in an exuberant inflammatory response, leading to nosocomial diarrhea, colitis and even death. To better understand the dynamics of mucosal immunity during C. difficile infection from initiation through expansion to resolution, we built a computational model of the mucosal immune response to the bacterium. The model was calibrated using data from a mouse model of C. difficile infection. The model demonstrates a crucial role of T helper 17 (Th17) effector responses in the colonic lamina propria and luminal commensal bacteria populations in the clearance of C. difficile and colonic pathology, whereas regulatory T (Treg) cells responses are associated with the recovery phase. In addition, the production of anti-microbial peptides by inflamed epithelial cells and activated neutrophils in response to C. difficile infection inhibit the re-growth of beneficial commensal bacterial species. Computational simulations suggest that the removal of neutrophil and epithelial cell derived anti-microbial inhibitions, separately and together, on commensal bacterial regrowth promote recovery and minimize colonic inflammatory pathology. Simulation results predict a decrease in colonic inflammatory markers, such as neutrophilic influx and Th17 cells in the colonic lamina propria, and length of infection with accelerated commensal bacteria re-growth through altered anti-microbial inhibition. Computational modeling provides novel insights on the therapeutic value of repopulating the colonic microbiome and inducing regulatory mucosal immune responses during C. difficile infection. Thus, modeling mucosal immunity-gut microbiota interactions has the potential to guide the development of targeted fecal transplantation therapies in the context of precision medicine interventions.

This model is hosted on BioModels Database and identified by: BIOMD0000000583.

To cite BioModels Database, please use: BioModels Database: An enhanced, curated and annotated resource for published quantitative kinetic models.

2 Unit Definitions

This is an overview of five unit definitions of which two are predefined by SBML and not mentioned in the model.

2.1 Unit `volume`

Name volume

Definition dimensionless

2.2 Unit time

Name time

Definition 86400 s

2.3 Unit substance

Name substance

Definition item

2.4 Unit area

Notes Square metre is the predefined SBML unit for area since SBML Level 2 Version 1.

Definition m^2

2.5 Unit length

Notes Metre is the predefined SBML unit for length since SBML Level 2 Version 1.

Definition m

3 Compartments

This model contains four compartments.

Table 2: Properties of all compartments.

Id	Name	SBO	Spatial Dimensions	Size	Unit	Constant	Outside
Lumen	Lumen		3	1	dimensionless	☑	
Epithelium	Epithelium		3	4	dimensionless	☑	
LP	LP		3	0.07	dimensionless	☑	
MLN	MLN		3	1	dimensionless	☑	

3.1 Compartment Lumen

This is a three dimensional compartment with a constant size of one dimensionless.

Name Lumen

3.2 Compartment Epithelium

This is a three dimensional compartment with a constant size of four dimensionless.

Name Epithelium

3.3 Compartment LP

This is a three dimensional compartment with a constant size of 0.07 dimensionless.

Name LP

3.4 Compartment MLN

This is a three dimensional compartment with a constant size of one dimensionless.

Name MLN

4 Species

This model contains 23 species. The boundary condition of four of these species is set to `true` so that these species' amount cannot be changed by any reaction. Section 7 provides further details and the derived rates of change of each species.

Table 3: Properties of each species.

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
Cdiff	Cdiff	Lumen	item · dimensionless^{-1}	⊟	⊟
Commensal_Beneficial	Commensal_Beneficial	Lumen	item · dimensionless^{-1}	⊟	⊟
Commensal_Dead	Commensal_Dead	Lumen	item · dimensionless^{-1}	⊟	⊟
tDC_LP	tDC_LP	Lumen	item · dimensionless^{-1}	⊟	⊟
tDC_MLN	tDC_MLN	Lumen	item · dimensionless^{-1}	⊟	⊟
Commensal_Harmful	Commensal_Harmful	Lumen	item · dimensionless^{-1}	⊟	⊟
N_Lum	N_Lum	Lumen	item · dimensionless^{-1}	⊟	⊟
E	E	Epithelium	item · dimensionless^{-1}	⊟	⊟
E_d	E_d	Epithelium	item · dimensionless^{-1}	⊟	⊟
iDC_E	iDC_E	Epithelium	item · dimensionless^{-1}	☑	☑

Id	Name	Compartment	Derived Unit	Constant	Boundary Condition
E_i	E_i	Epithelium	item dimensionless^{-1} ·	⊟	⊟
M_LP	M_LP	Epithelium	item dimensionless^{-1} ·	⊟	⊟
eDC_LP	eDC_LP	LP	item dimensionless^{-1} ·	⊟	⊟
M0	M0	LP	item dimensionless^{-1} ·	☑	☑
N_LP	N_LP	LP	item dimensionless^{-1} ·	☑	☑
Th17_LP	Th17_LP	LP	item dimensionless^{-1} ·	⊟	⊟
Th1_LP	Th1_LP	LP	item dimensionless^{-1} ·	⊟	⊟
iTreg_LP	iTreg_LP	LP	item dimensionless^{-1} ·	⊟	⊟
eDC_MLN	eDC_MLN	MLN	item dimensionless^{-1} ·	⊟	⊟
iTreg_MLN	iTreg_MLN	MLN	item dimensionless^{-1} ·	⊟	⊟
nT	nT	MLN	item dimensionless^{-1} ·	☑	☑
Th17_MLN	Th17_MLN	MLN	item dimensionless^{-1} ·	⊟	⊟
Th1_MLN	Th1_MLN	MLN	item dimensionless^{-1} ·	⊟	⊟

5 Function definitions

This is an overview of eleven function definitions.

5.1 Function definition KSA

Name KSA

Arguments K, S, A

Mathematical Expression

$$K \cdot S \cdot A \tag{1}$$

5.2 Function definition Rate_Law_for_E_damage

Name Rate Law for E damage

Arguments v, S, k1, a1, k2, a2, k3, a3

Mathematical Expression

$$v \cdot S \cdot (k1 \cdot a1 + k2 \cdot a2 + k3 \cdot a3) \tag{2}$$

5.3 Function definition Rate_Law_for_Th17plas

Name Rate Law for Th17plas

Arguments k1, s, k2, m2, p

Mathematical Expression

$$k1 \cdot s - k2 \cdot m2 \cdot p \tag{3}$$

5.4 Function definition Rate_Law_for_Effector_DC_Production_1

Name Rate Law for Effector DC Production_1

Arguments k, S

Mathematical Expression

$$k \cdot S \tag{4}$$

5.5 Function definition Rate_Law_for_eDC

Name Rate Law for eDC

Arguments K, S, M1, M2, k2, M3, k1

Mathematical Expression

$$\frac{K \cdot S \cdot M1}{k1 \cdot M2 + k2 \cdot M3} \tag{5}$$

5.6 Function definition Rate_Law_for_CD_Lumen_death

Name Rate Law for CD_Lumen death

Arguments K, S, A1, m2, A2, m3, A3

Mathematical Expression

$$K \cdot S \cdot (A1 + m2 \cdot A2 - m3 \cdot A3) \tag{6}$$

5.7 Function definition Rate_Law_for_tDC_Production

Name Rate Law for tDC Production

Arguments K, S, k1, M1, M2, k2, M3, M4

Mathematical Expression

$$K \cdot S \cdot \left(\frac{k1 \cdot M1}{M2} + \frac{k2 \cdot M3}{M4 + 100} \right) \tag{7}$$

5.8 Function definition Rate_Law_for_M_Activation

Name Rate Law for M Activation

Arguments K, S, e1, A1, A2, e2, I1

Mathematical Expression

$$K \cdot S \cdot (e1 \cdot A1 + A2 - e2 \cdot I1) \tag{8}$$

5.9 Function definition Rate_Law_for_N_Activation_Migration

Name Rate Law for N Activation/Migration

Arguments v, S, m, k1, A1, k2, A2, k3, I1

Mathematical Expression

$$v \cdot S \cdot (m \cdot (k1 \cdot A1 + k2 \cdot A2) - k3 \cdot I1) \tag{9}$$

5.10 Function definition Rate_Law_for_Commensal_Regrowth

Name Rate Law for Commensal Regrowth

Arguments k1, S, m1, m2, k2, P

Mathematical Expression

$$k1 \cdot S \cdot m1 \cdot m2 - k2 \cdot P \tag{10}$$

5.11 Function definition Rate_Law_for_Commensal_Harmful_Death_1

Name Rate Law for Commensal Harmful Death_1

Arguments K, S, m1, A1, m2, A2

Mathematical Expression

$$\mathrm{K} \cdot \mathrm{S} \cdot (\mathrm{m1} \cdot \mathrm{A1} + \mathrm{m2} \cdot \mathrm{A2}) \tag{11}$$

6 Reactions

This model contains 30 reactions. All reactions are listed in the following table and are subsequently described in detail. If a reaction is affected by a modifier, the identifier of this species is written above the reaction arrow.

Table 4: Overview of all reactions

№	Id	Name	Reaction Equation	SBO
1	Treg-_Degradation	Treg Degradation	$\text{iTreg\_LP} \xrightarrow{\text{Cdiff, iTreg\_LP, iTreg\_LP}} \emptyset$	
2	eDC_Degradation	eDC Degradation	$\text{eDC\_MLN} \xrightarrow{\text{iTreg\_MLN, eDC\_MLN, eDC\_MLN}} \emptyset$	
3	Th17-_Degradation	Th17 Degradation	$\text{Th17\_LP} \xrightarrow{\text{iTreg\_LP, Th17\_LP, Th17\_LP}} \emptyset$	
4	Th1_Degradation	Th1 Degradation	$\text{Th1\_LP} \xrightarrow{\text{iTreg\_LP, Commensal\_Dead, Th1\_LP, Th1\_LP}} \emptyset$	
5	N_Degradation	N Degradation	$\text{N\_Lum} \xrightarrow{\text{Commensal\_Beneficial, N\_Lum, Commensal\_Beneficial, N\_Lum, Commensal\_}}$	
6	E_Damage	E Damage	$\text{E} \xrightarrow{\text{N\_Lum, Th17\_LP, M\_LP, E, N\_Lum, Th17\_LP, M\_LP, E, N\_Lum, Th17\_LP, M\_LP}}$	
7	eDC_Migration	eDC Migration	$\text{eDC\_LP} \xrightarrow{\text{eDC\_LP, eDC\_LP}} \text{eDC\_MLN}$	
8	eDC_Production	eDC Production	$\text{iDC\_E} + \text{Cdiff} \xrightarrow{\text{Commensal\_Dead, Commensal\_Beneficial, Cdiff, Cdiff}} \text{eDC\_LP}$	
9	Cdiff_Death	Cdiff Death	$\text{Cdiff} \xrightarrow{\text{M\_LP, N\_Lum, Commensal\_Harmful, Cdiff, M\_LP, N\_Lum, Commensal\_Harmfu}}$	
10	N_Activation-_Migration	N Activation/Migration	$\text{N\_LP} \xrightarrow{\text{Cdiff, E\_d, Th17\_LP, iTreg\_LP, N\_LP, Cdiff, E\_d, Th17\_LP, iTreg\_LP, N\_LP, C}}$	
11	Cdiff_Growth	Cdiff Growth	$\text{Cdiff} \xrightarrow{\text{Commensal\_Harmful, Commensal\_Beneficial, Cdiff, Commensal\_Harmful, Cdiff}}$	
12	Treg_Migration	Treg Migration	$\text{iTreg\_MLN} \xrightarrow{\text{E\_i, iTreg\_MLN, iTreg\_MLN}} \text{iTreg\_LP}$	
13	Th1_Migration	Th1 Migration	$\text{Th1\_MLN} \xrightarrow{\text{E\_i, Th1\_MLN, Th1\_MLN}} \text{Th1\_LP}$	

№	Id	Name	Reaction Equation	SBO
14	Th17_Plasticity	Th17 Plasticity	$\text{Th17\_LP} \xrightleftharpoons{\text{Cdiff, Th17\_LP, Cdiff, iTreg\_LP, Th17\_LP, Cdiff, iTreg\_LP}} \text{iTreg\_LP}$	
15	Th17_Migration	Th17 Migration	$\text{Th17\_MLN} \xrightarrow{\text{E\_i, Th17\_MLN, Th17\_MLN}} \text{Th17\_LP}$	
16	E_Inflame	E Inflame	$\text{E} \xrightarrow{\text{Cdiff, E, Cdiff, E, Cdiff}} \text{E\_i}$	
17	E_i_Damage	E_i Damage	$\text{E\_i} \xrightarrow{\text{N\_Lum, Th17\_LP, M\_LP, E\_i, N\_Lum, Th17\_LP, M\_LP, E\_i, N\_Lum, Th17\_LP, M}}$	
18	M_Activation	M Activation	$\text{M0} \xrightarrow{\text{Th17\_LP, Cdiff, iTreg\_LP, M0, Th17\_LP, Cdiff, iTreg\_LP, M0, Th17\_LP, Cdiff, iT}}$	
19	M_Death	M Death	$\text{M\_LP} \xrightarrow{\text{iTreg\_LP, M\_LP, M\_LP}} \emptyset$	
20	Commensal_Regrowth	Commensal Regrowth	$\text{Commensal\_Beneficial} \xrightleftharpoons{\text{N\_Lum, E\_i, Commensal\_Beneficial, N\_Lum, E\_i, Commensal}}$	
21	E_Heal	E Heal	$\text{E\_d} \xrightarrow{\text{E\_d, E\_d}} \text{E}$	
22	tDC_Production	tDC Production	$\text{iDC\_E} + \text{Cdiff} \xrightarrow{\text{Commensal\_Beneficial, Commensal\_Dead, E, E\_i, Cdiff, Commensal\_B}}$	
23	tDC_Migration	tDC Migration	$\text{tDC\_LP} \xrightarrow{\text{tDC\_LP, tDC\_LP}} \text{tDC\_MLN}$	
24	tDC_Degradation	tDC Degradation	$\text{tDC\_MLN} \xrightarrow{\text{iTreg\_MLN, tDC\_MLN, tDC\_MLN}} \emptyset$	
25	Th17_Differentiation	Th17 Differentiation	$\text{eDC\_MLN} \xrightarrow{\text{eDC\_MLN, eDC\_MLN}} \text{Th17\_MLN}$	
26	Th1_Differentiation	Th1 Differentiation	$\text{eDC\_MLN} \xrightarrow{\text{Commensal\_Dead, Commensal\_Beneficial, E, eDC\_MLN, Commensal\_Dea}}$	
27	Treg_Differentiation	Treg Differentiation	$\text{tDC\_MLN} \xrightarrow{\text{tDC\_MLN, tDC\_MLN}} \text{iTreg\_MLN}$	
28	Commensal_Harmful_Death	Commensal Harmful Death	$\text{Commensal\_Harmful} \xrightarrow{\text{N\_LP, E\_i, Commensal\_Harmful, N\_LP, E\_i, Commensal\_Harmfu}}$	
29	Commensal_Death	Commensal Death	$\text{Commensal\_Dead} \xrightarrow{\text{Commensal\_Dead, Commensal\_Dead}} \emptyset$	

№	Id	Name	Reaction Equation	SBO
30	E_i_Natural_Death	E_i Natural Death	$\text{E\_i} \xrightarrow{\text{E\_i, E\_i}} \text{E\_d}$	

6.1 Reaction Treg_Degradation

This is an irreversible reaction of one reactant forming no product influenced by three modifiers.

Name Treg Degradation

Reaction equation

$$\text{iTreg\_LP} \xrightarrow{\text{Cdiff, iTreg\_LP, iTreg\_LP}} \emptyset \tag{12}$$

Reactant

Table 5: Properties of each reactant.

Id	Name	SBO
iTreg_LP	iTreg_LP	

Modifiers

Table 6: Properties of each modifier.

Id	Name	SBO
Cdiff	Cdiff	
iTreg_LP	iTreg_LP	
iTreg_LP	iTreg_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_1 = \text{vol}\,(\text{LP}) \cdot \text{k1} \cdot [\text{iTreg\_LP}] \tag{13}$$

Table 7: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.507		☑

6.2 Reaction eDC_Degradation

This is an irreversible reaction of one reactant forming no product influenced by three modifiers.

Name eDC Degradation

Reaction equation

$$\text{eDC\_MLN} \xrightarrow{\text{iTreg\_MLN, eDC\_MLN, eDC\_MLN}} \emptyset \tag{14}$$

Reactant

Table 8: Properties of each reactant.

Id	Name	SBO
eDC_MLN	eDC_MLN	

Modifiers

Table 9: Properties of each modifier.

Id	Name	SBO
iTreg_MLN	iTreg_MLN	
eDC_MLN	eDC_MLN	
eDC_MLN	eDC_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_2 = \text{vol}\,(\text{MLN}) \cdot \text{k1} \cdot [\text{eDC\_MLN}] \tag{15}$$

Table 10: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		$1.72495199303666 \cdot 10^{-5}$		☑

6.3 Reaction Th17_Degradation

This is an irreversible reaction of one reactant forming no product influenced by three modifiers.

Name Th17 Degradation

Reaction equation

$$\text{Th17\_LP} \xrightarrow{\text{iTreg\_LP, Th17\_LP, Th17\_LP}} \emptyset \tag{16}$$

Reactant

Table 11: Properties of each reactant.

Id	Name	SBO
Th17_LP	Th17_LP	

Modifiers

Table 12: Properties of each modifier.

Id	Name	SBO
iTreg_LP	iTreg_LP	
Th17_LP	Th17_LP	
Th17_LP	Th17_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_3 = \mathrm{vol}\,(\mathrm{LP}) \cdot \mathrm{k1} \cdot [\mathrm{Th17\_LP}] \tag{17}$$

Table 13: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		2.397		☑

6.4 Reaction Th1_Degradation

This is an irreversible reaction of one reactant forming no product influenced by four modifiers.

Name Th1 Degradation

Reaction equation

$$\mathrm{Th1\_LP} \xrightarrow{\mathrm{iTreg\_LP,\ Commensal\_Dead,\ Th1\_LP,\ Th1\_LP}} \emptyset \tag{18}$$

Reactant

Table 14: Properties of each reactant.

Id	Name	SBO
Th1_LP	Th1_LP	

Modifiers

Table 15: Properties of each modifier.

Id	Name	SBO
iTreg_LP	iTreg_LP	
Commensal_Dead	Commensal_Dead	
Th1_LP	Th1_LP	
Th1_LP	Th1_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_4 = \mathrm{vol}\,(\mathrm{LP}) \cdot \mathrm{k1} \cdot [\mathrm{Th1\_LP}] \tag{19}$$

Table 16: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.995		☑

6.5 Reaction N_Degradation

This is an irreversible reaction of one reactant forming no product influenced by five modifiers.

Name N Degradation

Reaction equation

$$\mathrm{N\_Lum} \xrightarrow{\text{Commensal\_Beneficial, N\_Lum, Commensal\_Beneficial, N\_Lum, Commensal\_Beneficial}} \emptyset \tag{20}$$

Reactant

Table 17: Properties of each reactant.

Id	Name	SBO
N_Lum	N_Lum	

Modifiers

Table 18: Properties of each modifier.

Id	Name	SBO
Commensal_Beneficial	Commensal_Beneficial	
N_Lum	N_Lum	
Commensal_Beneficial	Commensal_Beneficial	
N_Lum	N_Lum	
Commensal_Beneficial	Commensal_Beneficial	

Kinetic Law

Derived unit contains undeclared units

$$v_5 = \mathrm{vol}\,(\mathrm{Lumen}) \cdot \mathrm{KSA}\,(\mathrm{K}, [\mathrm{N\_Lum}], [\mathrm{Commensal\_Beneficial}]) \tag{21}$$

$$\mathrm{KSA}\,(\mathrm{K}, \mathrm{S}, \mathrm{A}) = \mathrm{K} \cdot \mathrm{S} \cdot \mathrm{A} \tag{22}$$

$$\mathrm{KSA}\,(\mathrm{K}, \mathrm{S}, \mathrm{A}) = \mathrm{K} \cdot \mathrm{S} \cdot \mathrm{A} \tag{23}$$

Table 19: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$2.35932924820229 \cdot 10^{-7}$		☑

6.6 Reaction E_Damage

This is an irreversible reaction of one reactant forming one product influenced by eleven modifiers.

Name E Damage

Reaction equation

$$\mathrm{E} \xrightarrow{\mathrm{N\_Lum},\ \mathrm{Th17\_LP},\ \mathrm{M\_LP},\ \mathrm{E},\ \mathrm{N\_Lum},\ \mathrm{Th17\_LP},\ \mathrm{M\_LP},\ \mathrm{E},\ \mathrm{N\_Lum},\ \mathrm{Th17\_LP},\ \mathrm{M\_LP}} \mathrm{E\_d} \tag{24}$$

Reactant

Table 20: Properties of each reactant.

Id	Name	SBO
E	E	

Modifiers

Table 21: Properties of each modifier.

Id	Name	SBO
N_Lum	N_Lum	
Th17_LP	Th17_LP	
M_LP	M_LP	
E	E	
N_Lum	N_Lum	
Th17_LP	Th17_LP	
M_LP	M_LP	
E	E	
N_Lum	N_Lum	
Th17_LP	Th17_LP	
M_LP	M_LP	

Product

Table 22: Properties of each product.

Id	Name	SBO
E_d	E_d	

Kinetic Law

Derived unit contains undeclared units

$$v_6 = \mathrm{vol}\left(\mathrm{Epithelium}\right) \cdot \mathrm{Rate\_Law\_for\_E\_damage}\left(\mathrm{v}, [\mathrm{E}], \mathrm{k1}, [\mathrm{N\_Lum}], \mathrm{k2}, [\mathrm{Th17\_LP}], \mathrm{k3}, [\mathrm{M\_LP}]\right) \tag{25}$$

$$\text{Rate\_Law\_for\_E\_damage}\,(\text{v},\text{S},\text{k1},\text{a1},\text{k2},\text{a2},\text{k3},\text{a3}) = \text{v}\cdot\text{S}\cdot(\text{k1}\cdot\text{a1}+\text{k2}\cdot\text{a2}+\text{k3}\cdot\text{a3}) \quad (26)$$

$$\text{Rate\_Law\_for\_E\_damage}\,(\text{v},\text{S},\text{k1},\text{a1},\text{k2},\text{a2},\text{k3},\text{a3}) = \text{v}\cdot\text{S}\cdot(\text{k1}\cdot\text{a1}+\text{k2}\cdot\text{a2}+\text{k3}\cdot\text{a3}) \quad (27)$$

Table 23: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
v	v		$1.59920673150176\cdot10^{-6}$		☑
k1	k1		$1.1\cdot10^{-5}$		☑
k2	k2		$2.3381277077344\cdot10^{-6}$		☑
k3	k3		62.591		☑

6.7 Reaction eDC_Migration

This is an irreversible reaction of one reactant forming one product influenced by two modifiers.

Name eDC Migration

Reaction equation

$$\text{eDC\_LP} \xrightarrow{\text{eDC\_LP, eDC\_LP}} \text{eDC\_MLN} \quad (28)$$

Reactant

Table 24: Properties of each reactant.

Id	Name	SBO
eDC_LP	eDC_LP	

Modifiers

Table 25: Properties of each modifier.

Id	Name	SBO
eDC_LP	eDC_LP	
eDC_LP	eDC_LP	

Product

Table 26: Properties of each product.

Id	Name	SBO
eDC_MLN	eDC_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_7 = \mathrm{k1} \cdot [\mathrm{eDC\_LP}] \tag{29}$$

Table 27: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		10.5		☑

6.8 Reaction eDC_Production

This is an irreversible reaction of two reactants forming one product influenced by four modifiers.

Name eDC Production

Reaction equation

$$\mathrm{iDC\_E} + \mathrm{Cdiff} \xrightarrow{\text{Commensal\_Dead, Commensal\_Beneficial, Cdiff, Cdiff}} \mathrm{eDC\_LP} \tag{30}$$

Reactants

Table 28: Properties of each reactant.

Id	Name	SBO
iDC_E	iDC_E	
Cdiff	Cdiff	

Modifiers

Table 29: Properties of each modifier.

Id	Name	SBO
Commensal_Dead	Commensal_Dead	

Id	Name	SBO
Commensal_Beneficial	Commensal_Beneficial	
Cdiff	Cdiff	
Cdiff	Cdiff	

Product

Table 30: Properties of each product.

Id	Name	SBO
eDC_LP	eDC_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_8 = \text{Rate\_Law\_for\_Effector\_DC\_Production\_1}\,(\text{k}, [\text{Cdiff}]) \tag{31}$$

$$\text{Rate\_Law\_for\_Effector\_DC\_Production\_1}\,(\text{k}, \text{S}) = \text{k} \cdot \text{S} \tag{32}$$

Table 31: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k	k		0.55		☑

6.9 Reaction Cdiff_Death

This is an irreversible reaction of one reactant forming no product influenced by eleven modifiers.

Name Cdiff Death

Reaction equation

$$\text{Cdiff} \xrightarrow{\text{M\_LP, N\_Lum, Commensal\_Harmful, Cdiff, M\_LP, N\_Lum, Commensal\_Harmful, Cdiff, M\_LP, N\_Lum, Cor}} \tag{33}$$

Reactant

Table 32: Properties of each reactant.

Id	Name	SBO
Cdiff	Cdiff	

Modifiers

Table 33: Properties of each modifier.

Id	Name	SBO
M_LP	M_LP	
N_Lum	N_Lum	
Commensal_Harmful	Commensal_Harmful	
Cdiff	Cdiff	
M_LP	M_LP	
N_Lum	N_Lum	
Commensal_Harmful	Commensal_Harmful	
Cdiff	Cdiff	
M_LP	M_LP	
N_Lum	N_Lum	
Commensal_Harmful	Commensal_Harmful	

Kinetic Law

Derived unit contains undeclared units

$$v_9 = \mathrm{vol}\,(\mathrm{Lumen}) \cdot \mathrm{Rate\_Law\_for\_CD\_Lumen\_death}\,(\mathrm{K}, [\mathrm{Cdiff}], [\mathrm{M\_LP}], \mathrm{m2}, [\mathrm{N\_Lum}], \mathrm{m3}, [\mathrm{Commensal\_Harmful}]) \quad (34)$$

$$\mathrm{Rate\_Law\_for\_CD\_Lumen\_death}\,(\mathrm{K}, \mathrm{S}, \mathrm{A1}, \mathrm{m2}, \mathrm{A2}, \mathrm{m3}, \mathrm{A3}) = \mathrm{K} \cdot \mathrm{S} \cdot (\mathrm{A1} + \mathrm{m2} \cdot \mathrm{A2} - \mathrm{m3} \cdot \mathrm{A3}) \quad (35)$$

$$\mathrm{Rate\_Law\_for\_CD\_Lumen\_death}\,(\mathrm{K}, \mathrm{S}, \mathrm{A1}, \mathrm{m2}, \mathrm{A2}, \mathrm{m3}, \mathrm{A3}) = \mathrm{K} \cdot \mathrm{S} \cdot (\mathrm{A1} + \mathrm{m2} \cdot \mathrm{A2} - \mathrm{m3} \cdot \mathrm{A3}) \quad (36)$$

Table 34: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$6.27092296294148 \cdot 10^{-10}$		☑
m2	m2		594.897		☑
m3	m3		0.103		☑

6.10 Reaction N_Activation_Migration

This is an irreversible reaction of one reactant forming one product influenced by 14 modifiers.

Name N Activation/Migration

Reaction equation

$$\mathrm{N\_LP} \xrightarrow{\mathrm{Cdiff},\ \mathrm{E\_d},\ \mathrm{Th17\_LP},\ \mathrm{iTreg\_LP},\ \mathrm{N\_LP},\ \mathrm{Cdiff},\ \mathrm{E\_d},\ \mathrm{Th17\_LP},\ \mathrm{iTreg\_LP},\ \mathrm{N\_LP},\ \mathrm{Cdiff},\ \mathrm{E\_d},\ \mathrm{Th17\_LP},\ \mathrm{iTreg\_LP}} \tag{37}$$

Reactant

Table 35: Properties of each reactant.

Id	Name	SBO
N_LP	N_LP	

Modifiers

Table 36: Properties of each modifier.

Id	Name	SBO
Cdiff	Cdiff	
E_d	E_d	
Th17_LP	Th17_LP	
iTreg_LP	iTreg_LP	
N_LP	N_LP	
Cdiff	Cdiff	
E_d	E_d	
Th17_LP	Th17_LP	
iTreg_LP	iTreg_LP	
N_LP	N_LP	
Cdiff	Cdiff	
E_d	E_d	
Th17_LP	Th17_LP	
iTreg_LP	iTreg_LP	

Product

Table 37: Properties of each product.

Id	Name	SBO
N_Lum	N_Lum	

Kinetic Law

Derived unit contains undeclared units

$$v_{10} = \text{Rate\_Law\_for\_N\_Activation\_Migration}\,(\text{v}, [\text{N\_LP}], [\text{Cdiff}], \text{k1}, [\text{E\_d}], \text{k2}, [\text{Th17\_LP}], \text{k3}, [\text{iTreg\_LP}]) \tag{38}$$

$$\begin{aligned}&\text{Rate\_Law\_for\_N\_Activation\_Migration}\,(\text{v}, \text{S}, \text{m}, \text{k1}, \text{A1}, \text{k2}, \text{A2}, \text{k3}, \text{I1})\\ &= \text{v} \cdot \text{S} \cdot (\text{m} \cdot (\text{k1} \cdot \text{A1} + \text{k2} \cdot \text{A2}) - \text{k3} \cdot \text{I1})\end{aligned} \tag{39}$$

Table 38: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
v	v		$5.29827880572231 \cdot 10^{-5}$		☑
k1	k1		0.121		☑
k2	k2		0.171		☑
k3	k3		0.130		☑

6.11 Reaction Cdiff_Growth

This is an irreversible reaction of one reactant forming one product influenced by six modifiers.

Name Cdiff Growth

Reaction equation

$$\text{Cdiff} \xrightarrow{\text{Commensal\_Harmful, Commensal\_Beneficial, Cdiff, Commensal\_Harmful, Cdiff, Commensal\_Harmful}} 2\,\text{Cdi} \tag{40}$$

Reactant

Table 39: Properties of each reactant.

Id	Name	SBO
Cdiff	Cdiff	

Modifiers

Table 40: Properties of each modifier.

Id	Name	SBO
Commensal_Harmful	Commensal_Harmful	
Commensal_Beneficial	Commensal_Beneficial	
Cdiff	Cdiff	
Commensal_Harmful	Commensal_Harmful	
Cdiff	Cdiff	
Commensal_Harmful	Commensal_Harmful	

Product

Table 41: Properties of each product.

Id	Name	SBO
Cdiff	Cdiff	

Kinetic Law

Derived unit contains undeclared units

$$v_{11} = \mathrm{vol}\left(\mathrm{Lumen}\right) \cdot \mathrm{KSA}\left(\mathrm{K}, [\mathrm{Cdiff}], [\mathrm{Commensal\_Harmful}]\right) \tag{41}$$

$$\mathrm{KSA}\left(\mathrm{K}, \mathrm{S}, \mathrm{A}\right) = \mathrm{K} \cdot \mathrm{S} \cdot \mathrm{A} \tag{42}$$

$$\mathrm{KSA}\left(\mathrm{K}, \mathrm{S}, \mathrm{A}\right) = \mathrm{K} \cdot \mathrm{S} \cdot \mathrm{A} \tag{43}$$

Table 42: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$5 \cdot 10^{-11}$		☑

6.12 Reaction Treg_Migration

This is an irreversible reaction of one reactant forming one product influenced by three modifiers.

Name Treg Migration

Reaction equation

$$\text{iTreg\_MLN} \xrightarrow{\text{E\_i, iTreg\_MLN, iTreg\_MLN}} \text{iTreg\_LP} \tag{44}$$

Reactant

Table 43: Properties of each reactant.

Id	Name	SBO
iTreg_MLN	iTreg_MLN	

Modifiers

Table 44: Properties of each modifier.

Id	Name	SBO
E_i	E_i	
iTreg_MLN	iTreg_MLN	
iTreg_MLN	iTreg_MLN	

Product

Table 45: Properties of each product.

Id	Name	SBO
iTreg_LP	iTreg_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{12} = \text{k1} \cdot [\text{iTreg\_MLN}] \tag{45}$$

Table 46: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		5.5		☑

6.13 Reaction Th1_Migration

This is an irreversible reaction of one reactant forming one product influenced by three modifiers.

Name Th1 Migration

Reaction equation

$$\text{Th1\_MLN} \xrightarrow{\text{E\_i, Th1\_MLN, Th1\_MLN}} \text{Th1\_LP} \tag{46}$$

Reactant

Table 47: Properties of each reactant.

Id	Name	SBO
Th1_MLN	Th1_MLN	

Modifiers

Table 48: Properties of each modifier.

Id	Name	SBO
E_i	E_i	
Th1_MLN	Th1_MLN	
Th1_MLN	Th1_MLN	

Product

Table 49: Properties of each product.

Id	Name	SBO
Th1_LP	Th1_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{13} = \text{k1} \cdot [\text{Th1\_MLN}] \tag{47}$$

Table 50: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		1.459		☑

6.14 Reaction Th17_Plasticity

This is a reversible reaction of one reactant forming one product influenced by seven modifiers.

Name Th17 Plasticity

Reaction equation

$$\text{Th17\_LP} \xrightleftharpoons{\text{Cdiff, Th17\_LP, Cdiff, iTreg\_LP, Th17\_LP, Cdiff, iTreg\_LP}} \text{iTreg\_LP} \tag{48}$$

Reactant

Table 51: Properties of each reactant.

Id	Name	SBO
Th17_LP	Th17_LP	

Modifiers

Table 52: Properties of each modifier.

Id	Name	SBO
Cdiff	Cdiff	
Th17_LP	Th17_LP	
Cdiff	Cdiff	
iTreg_LP	iTreg_LP	
Th17_LP	Th17_LP	
Cdiff	Cdiff	
iTreg_LP	iTreg_LP	

Product

Table 53: Properties of each product.

Id	Name	SBO
iTreg_LP	iTreg_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{14} = \mathrm{vol}\,(\mathrm{LP}) \cdot \mathrm{Rate\_Law\_for\_Th17plas}\,(\mathrm{k1}, [\mathrm{Th17\_LP}], \mathrm{k2}, [\mathrm{Cdiff}], [\mathrm{iTreg\_LP}]) \quad (49)$$

$$\mathrm{Rate\_Law\_for\_Th17plas}\,(\mathrm{k1}, \mathrm{s}, \mathrm{k2}, \mathrm{m2}, \mathrm{p}) = \mathrm{k1} \cdot \mathrm{s} - \mathrm{k2} \cdot \mathrm{m2} \cdot \mathrm{p} \quad (50)$$

$$\mathrm{Rate\_Law\_for\_Th17plas}\,(\mathrm{k1}, \mathrm{s}, \mathrm{k2}, \mathrm{m2}, \mathrm{p}) = \mathrm{k1} \cdot \mathrm{s} - \mathrm{k2} \cdot \mathrm{m2} \cdot \mathrm{p} \quad (51)$$

Table 54: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		1.274		☑
k2	k2		0.002		☑

6.15 Reaction Th17_Migration

This is an irreversible reaction of one reactant forming one product influenced by three modifiers.

Name Th17 Migration

Reaction equation

$$\mathrm{Th17\_MLN} \xrightarrow{\mathrm{E\_i,\ Th17\_MLN,\ Th17\_MLN}} \mathrm{Th17\_LP} \quad (52)$$

Reactant

Table 55: Properties of each reactant.

Id	Name	SBO
Th17_MLN	Th17_MLN	

Modifiers

Table 56: Properties of each modifier.

Id	Name	SBO
E_i	E_i	
Th17_MLN	Th17_MLN	

Id	Name	SBO
Th17_MLN	Th17_MLN	

Product

Table 57: Properties of each product.

Id	Name	SBO
Th17_LP	Th17_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{15} = \mathrm{k1} \cdot [\mathrm{Th17\_MLN}] \tag{53}$$

Table 58: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		2.505		☑

6.16 Reaction E_Inflame

This is an irreversible reaction of one reactant forming one product influenced by five modifiers.

Name E Inflame

Reaction equation

$$\mathrm{E} \xrightarrow{\text{Cdiff, E, Cdiff, E, Cdiff}} \mathrm{E\_i} \tag{54}$$

Reactant

Table 59: Properties of each reactant.

Id	Name	SBO
E	E	

Modifiers

Table 60: Properties of each modifier.

Id	Name	SBO
Cdiff	Cdiff	
E	E	
Cdiff	Cdiff	
E	E	
Cdiff	Cdiff	

Product

Table 61: Properties of each product.

Id	Name	SBO
E_i	E_i	

Kinetic Law

Derived unit contains undeclared units

$$v_{16} = \text{vol}\left(\text{Epithelium}\right) \cdot \text{KSA}\left(\text{K}, [\text{E}], [\text{Cdiff}]\right) \tag{55}$$

$$\text{KSA}\left(\text{K}, \text{S}, \text{A}\right) = \text{K} \cdot \text{S} \cdot \text{A} \tag{56}$$

$$\text{KSA}\left(\text{K}, \text{S}, \text{A}\right) = \text{K} \cdot \text{S} \cdot \text{A} \tag{57}$$

Table 62: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$1.71079818745428 \cdot 10^{-4}$		☑

6.17 Reaction E_i_Damage

This is an irreversible reaction of one reactant forming one product influenced by eleven modifiers.

Name E_i Damage

Reaction equation

$$\text{E\_i} \xrightarrow{\text{N\_Lum, Th17\_LP, M\_LP, E\_i, N\_Lum, Th17\_LP, M\_LP, E\_i, N\_Lum, Th17\_LP, M\_LP}} \text{E\_d} \quad (58)$$

Reactant

Table 63: Properties of each reactant.

Id	Name	SBO
E_i	E_i	

Modifiers

Table 64: Properties of each modifier.

Id	Name	SBO
N_Lum	N_Lum	
Th17_LP	Th17_LP	
M_LP	M_LP	
E_i	E_i	
N_Lum	N_Lum	
Th17_LP	Th17_LP	
M_LP	M_LP	
E_i	E_i	
N_Lum	N_Lum	
Th17_LP	Th17_LP	
M_LP	M_LP	

Product

Table 65: Properties of each product.

Id	Name	SBO
E_d	E_d	

Kinetic Law

Derived unit contains undeclared units

$$v_{17} = \mathrm{vol}\,(\mathrm{Epithelium}) \cdot \mathrm{Rate\_Law\_for\_E\_damage}\,(\mathrm{v}, [\mathrm{E\_i}], \mathrm{k1}, [\mathrm{N\_Lum}], \mathrm{k2}, [\mathrm{Th17\_LP}], \mathrm{k3}, [\mathrm{M\_LP}]) \quad (59)$$

$$\mathrm{Rate\_Law\_for\_E\_damage}\,(\mathrm{v}, \mathrm{S}, \mathrm{k1}, \mathrm{a1}, \mathrm{k2}, \mathrm{a2}, \mathrm{k3}, \mathrm{a3}) = \mathrm{v} \cdot \mathrm{S} \cdot (\mathrm{k1} \cdot \mathrm{a1} + \mathrm{k2} \cdot \mathrm{a2} + \mathrm{k3} \cdot \mathrm{a3}) \quad (60)$$

$$\mathrm{Rate\_Law\_for\_E\_damage}\,(\mathrm{v}, \mathrm{S}, \mathrm{k1}, \mathrm{a1}, \mathrm{k2}, \mathrm{a2}, \mathrm{k3}, \mathrm{a3}) = \mathrm{v} \cdot \mathrm{S} \cdot (\mathrm{k1} \cdot \mathrm{a1} + \mathrm{k2} \cdot \mathrm{a2} + \mathrm{k3} \cdot \mathrm{a3}) \quad (61)$$

Table 66: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
v	v		0.065		☑
k1	k1		0.006		☑
k2	k2		0.011		☑
k3	k3		$1.16013457036959 \cdot 10^{-6}$		☑

6.18 Reaction M_Activation

This is an irreversible reaction of one reactant forming one product influenced by eleven modifiers.

Name M Activation

Reaction equation

$$\mathrm{M0} \xrightarrow{\mathrm{Th17\_LP,\ Cdiff,\ iTreg\_LP,\ M0,\ Th17\_LP,\ Cdiff,\ iTreg\_LP,\ M0,\ Th17\_LP,\ Cdiff,\ iTreg\_LP}} \mathrm{M\_LP} \quad (62)$$

Reactant

Table 67: Properties of each reactant.

Id	Name	SBO
M0	M0	

Modifiers

Table 68: Properties of each modifier.

Id	Name	SBO
Th17_LP	Th17_LP	
Cdiff	Cdiff	
iTreg_LP	iTreg_LP	
M0	M0	
Th17_LP	Th17_LP	
Cdiff	Cdiff	
iTreg_LP	iTreg_LP	
M0	M0	
Th17_LP	Th17_LP	
Cdiff	Cdiff	
iTreg_LP	iTreg_LP	

Product

Table 69: Properties of each product.

Id	Name	SBO
M_LP	M_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{18} = \text{Rate\_Law\_for\_M\_Activation}\,(\text{K}, [\text{M0}], \text{e1}, [\text{Th17\_LP}], [\text{Cdiff}], \text{e2}, [\text{iTreg\_LP}]) \quad (63)$$

$$\text{Rate\_Law\_for\_M\_Activation}\,(\text{K}, \text{S}, \text{e1}, \text{A1}, \text{A2}, \text{e2}, \text{I1}) = \text{K} \cdot \text{S} \cdot (\text{e1} \cdot \text{A1} + \text{A2} - \text{e2} \cdot \text{I1}) \quad (64)$$

Table 70: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$4.5 \cdot 10^{-5}$		☑
e1	e1		2.000		☑
e2	e2		0.092		☑

6.19 Reaction M_Death

This is an irreversible reaction of one reactant forming no product influenced by three modifiers.

Name M Death

Reaction equation

$$\text{M\_LP} \xrightarrow{\text{iTreg\_LP, M\_LP, M\_LP}} \emptyset \tag{65}$$

Reactant

Table 71: Properties of each reactant.

Id	Name	SBO
M_LP	M_LP	

Modifiers

Table 72: Properties of each modifier.

Id	Name	SBO
iTreg_LP	iTreg_LP	
M_LP	M_LP	
M_LP	M_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{19} = \text{vol}\,(\text{Epithelium}) \cdot \text{k1} \cdot [\text{M\_LP}] \tag{66}$$

Table 73: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		20.0		☑

6.20 Reaction Commensal_Regrowth

This is a reversible reaction of one reactant forming one product influenced by ten modifiers.

Name Commensal Regrowth

Reaction equation

$$\text{Commensal\_Beneficial} \rightleftharpoons \text{N\_Lum, E\_i, Commensal\_Beneficial, N\_Lum, E\_i, Commensal\_Dead, Commensa} \quad (67)$$

Reactant

Table 74: Properties of each reactant.

Id	Name	SBO
Commensal_Beneficial	Commensal_Beneficial	

Modifiers

Table 75: Properties of each modifier.

Id	Name	SBO
N_Lum	N_Lum	
E_i	E_i	
Commensal_Beneficial	Commensal_Beneficial	
N_Lum	N_Lum	
E_i	E_i	
Commensal_Dead	Commensal_Dead	
Commensal_Beneficial	Commensal_Beneficial	
N_Lum	N_Lum	
E_i	E_i	
Commensal_Dead	Commensal_Dead	

Product

Table 76: Properties of each product.

Id	Name	SBO
Commensal_Dead	Commensal_Dead	

Kinetic Law

Derived unit contains undeclared units

$$v_{20} = \text{vol}\,(\text{Lumen}) \cdot \text{Rate\_Law\_for\_Commensal\_Regrowth}\,(\text{k1}, [\text{Commensal\_Beneficial}], [\text{N\_Lum}], [\text{E\_i}], \text{k2}, [\text{Commensal\_Dead}]) \quad (68)$$

$$\text{Rate\_Law\_for\_Commensal\_Regrowth}\,(\text{k1},\text{S},\text{m1},\text{m2},\text{k2},\text{P}) = \text{k1}\cdot\text{S}\cdot\text{m1}\cdot\text{m2} - \text{k2}\cdot\text{P} \quad (69)$$

$$\text{Rate\_Law\_for\_Commensal\_Regrowth}\,(\text{k1},\text{S},\text{m1},\text{m2},\text{k2},\text{P}) = \text{k1}\cdot\text{S}\cdot\text{m1}\cdot\text{m2} - \text{k2}\cdot\text{P} \quad (70)$$

Table 77: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		$4.5\cdot10^{-10}$		☑
k2	k2		0.156		☑

6.21 Reaction E_Heal

This is an irreversible reaction of one reactant forming one product influenced by two modifiers.

Name E Heal

Reaction equation

$$\text{E\_d} \xrightarrow{\text{E\_d, E\_d}} \text{E} \quad (71)$$

Reactant

Table 78: Properties of each reactant.

Id	Name	SBO
E_d	E_d	

Modifiers

Table 79: Properties of each modifier.

Id	Name	SBO
E_d	E_d	
E_d	E_d	

Product

Table 80: Properties of each product.

Id	Name	SBO
E	E	

Kinetic Law

Derived unit contains undeclared units

$$v_{21} = \text{vol}\,(\text{Epithelium}) \cdot \text{k1} \cdot [\text{E\_d}] \tag{72}$$

Table 81: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		4000.0		☑

6.22 Reaction tDC_Production

This is an irreversible reaction of two reactants forming one product influenced by 14 modifiers.

Name tDC Production

Reaction equation

$$\text{iDC\_E} + \text{Cdiff} \xrightarrow{\text{Commensal\_Beneficial, Commensal\_Dead, E, E\_i, Cdiff, Commensal\_Beneficial, Commensal\_Dead,}} \tag{73}$$

Reactants

Table 82: Properties of each reactant.

Id	Name	SBO
iDC_E	iDC_E	
Cdiff	Cdiff	

Modifiers

Table 83: Properties of each modifier.

Id	Name	SBO
Commensal_Beneficial	Commensal_Beneficial	

Id	Name	SBO
Commensal_Dead	Commensal_Dead	
E	E	
E_i	E_i	
Cdiff	Cdiff	
Commensal_Beneficial	Commensal_Beneficial	
Commensal_Dead	Commensal_Dead	
E	E	
E_i	E_i	
Cdiff	Cdiff	
Commensal_Beneficial	Commensal_Beneficial	
Commensal_Dead	Commensal_Dead	
E	E	
E_i	E_i	

Product

Table 84: Properties of each product.

Id	Name	SBO
tDC_LP	tDC_LP	

Kinetic Law

Derived unit contains undeclared units

$$v_{22} = \text{Rate\_Law\_for\_tDC\_Production}\,(\text{K}, [\text{Cdiff}], \text{k1}, [\text{Commensal\_Beneficial}], [\text{Commensal\_Dead}], \text{k2}, [\text{E}], [\text{E\_i}]) \tag{74}$$

$$\text{Rate\_Law\_for\_tDC\_Production}\,(\text{K}, \text{S}, \text{k1}, \text{M1}, \text{M2}, \text{k2}, \text{M3}, \text{M4}) = \text{K} \cdot \text{S} \cdot \left(\frac{\text{k1} \cdot \text{M1}}{\text{M2}} + \frac{\text{k2} \cdot \text{M3}}{\text{M4} + 100} \right) \tag{75}$$

Table 85: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$2 \cdot 10^{-4}$		☑
k1	k1		559.297		☑
k2	k2		26.875		☑

6.23 Reaction tDC_Migration

This is an irreversible reaction of one reactant forming one product influenced by two modifiers.

Name tDC Migration

Reaction equation

$$\text{tDC\_LP} \xrightarrow{\text{tDC\_LP, tDC\_LP}} \text{tDC\_MLN} \tag{76}$$

Reactant

Table 86: Properties of each reactant.

Id	Name	SBO
tDC_LP	tDC_LP	

Modifiers

Table 87: Properties of each modifier.

Id	Name	SBO
tDC_LP	tDC_LP	
tDC_LP	tDC_LP	

Product

Table 88: Properties of each product.

Id	Name	SBO
tDC_MLN	tDC_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_{23} = \text{vol}\,(\text{Lumen}) \cdot \text{k1} \cdot [\text{tDC\_LP}] \tag{77}$$

Table 89: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		3.65		☑

6.24 Reaction tDC_Degradation

This is an irreversible reaction of one reactant forming no product influenced by three modifiers.

Name tDC Degradation

Reaction equation

$$\text{tDC\_MLN} \xrightarrow{\text{iTreg\_MLN, tDC\_MLN, tDC\_MLN}} \emptyset \tag{78}$$

Reactant

Table 90: Properties of each reactant.

Id	Name	SBO
tDC_MLN	tDC_MLN	

Modifiers

Table 91: Properties of each modifier.

Id	Name	SBO
iTreg_MLN	iTreg_MLN	
tDC_MLN	tDC_MLN	
tDC_MLN	tDC_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_{24} = \text{vol}\left(\text{Lumen}\right) \cdot \text{Rate\_Law\_for\_Effector\_DC\_Production\_1}\left(\text{k}, [\text{tDC\_MLN}]\right) \tag{79}$$

$$\text{Rate\_Law\_for\_Effector\_DC\_Production\_1}\left(\text{k}, \text{S}\right) = \text{k} \cdot \text{S} \tag{80}$$

$$\text{Rate\_Law\_for\_Effector\_DC\_Production\_1}\left(\text{k}, \text{S}\right) = \text{k} \cdot \text{S} \tag{81}$$

Table 92: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k	k		$9.5 \cdot 10^{-4}$		☑

6.25 Reaction Th17_Differentiation

This is an irreversible reaction of one reactant forming one product influenced by two modifiers.

Name Th17 Differentiation

Reaction equation

$$\text{eDC\_MLN} \xrightarrow{\text{eDC\_MLN, eDC\_MLN}} \text{Th17\_MLN} \tag{82}$$

Reactant

Table 93: Properties of each reactant.

Id	Name	SBO
eDC_MLN	eDC_MLN	

Modifiers

Table 94: Properties of each modifier.

Id	Name	SBO
eDC_MLN	eDC_MLN	
eDC_MLN	eDC_MLN	

Product

Table 95: Properties of each product.

Id	Name	SBO
Th17_MLN	Th17_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_{25} = \text{vol}\,(\text{MLN}) \cdot \text{k1} \cdot [\text{eDC\_MLN}] \tag{83}$$

Table 96: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		2255.805		☑

6.26 Reaction Th1_Differentiation

This is an irreversible reaction of one reactant forming one product influenced by eleven modifiers.

Name Th1 Differentiation

Reaction equation

eDC_MLN $\xrightarrow{\text{Commensal\_Dead, Commensal\_Beneficial, E, eDC\_MLN, Commensal\_Dead, Commensal\_Beneficial, E}}$

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Reactant

Table 97: Properties of each reactant.

Id	Name	SBO
eDC_MLN	eDC_MLN	

Modifiers

Table 98: Properties of each modifier.

Id	Name	SBO
Commensal_Dead	Commensal_Dead	
Commensal_Beneficial	Commensal_Beneficial	
E	E	
eDC_MLN	eDC_MLN	
Commensal_Dead	Commensal_Dead	
Commensal_Beneficial	Commensal_Beneficial	
E	E	
eDC_MLN	eDC_MLN	
Commensal_Dead	Commensal_Dead	
Commensal_Beneficial	Commensal_Beneficial	
E	E	

Product

Table 99: Properties of each product.

Id	Name	SBO
Th1_MLN	Th1_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_{26} = \mathrm{vol}\,(\mathrm{MLN}) \cdot \mathrm{Rate\_Law\_for\_eDC}\,(\mathrm{K}, [\mathrm{eDC\_MLN}], [\mathrm{Commensal\_Dead}], [\mathrm{Commensal\_Beneficial}], \mathrm{k2}, [\mathrm{E}], \mathrm{k1}) \tag{85}$$

$$\mathrm{Rate\_Law\_for\_eDC}\,(\mathrm{K}, \mathrm{S}, \mathrm{M1}, \mathrm{M2}, \mathrm{k2}, \mathrm{M3}, \mathrm{k1}) = \frac{\mathrm{K} \cdot \mathrm{S} \cdot \mathrm{M1}}{\mathrm{k1} \cdot \mathrm{M2} + \mathrm{k2} \cdot \mathrm{M3}} \tag{86}$$

$$\mathrm{Rate\_Law\_for\_eDC}\,(\mathrm{K}, \mathrm{S}, \mathrm{M1}, \mathrm{M2}, \mathrm{k2}, \mathrm{M3}, \mathrm{k1}) = \frac{\mathrm{K} \cdot \mathrm{S} \cdot \mathrm{M1}}{\mathrm{k1} \cdot \mathrm{M2} + \mathrm{k2} \cdot \mathrm{M3}} \tag{87}$$

Table 100: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		0.043		☑
k2	k2		$9.65568121975566 \cdot 10^{-5}$		☑
k1	k1		0.065		☑

6.27 Reaction Treg_Differentiation

This is an irreversible reaction of one reactant forming one product influenced by two modifiers.

Name Treg Differentiation

Reaction equation

$$\mathrm{tDC\_MLN} \xrightarrow{\mathrm{tDC\_MLN},\ \mathrm{tDC\_MLN}} \mathrm{iTreg\_MLN} \tag{88}$$

Reactant

Table 101: Properties of each reactant.

Id	Name	SBO
tDC_MLN	tDC_MLN	

Modifiers

Table 102: Properties of each modifier.

Id	Name	SBO
tDC_MLN	tDC_MLN	
tDC_MLN	tDC_MLN	

Product

Table 103: Properties of each product.

Id	Name	SBO
iTreg_MLN	iTreg_MLN	

Kinetic Law

Derived unit contains undeclared units

$$v_{27} = \mathrm{k1} \cdot [\mathrm{tDC\_MLN}] \tag{89}$$

Table 104: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		53.913		☑

6.28 Reaction Commensal_Harmful_Death

This is an irreversible reaction of one reactant forming no product influenced by eight modifiers.

Name Commensal Harmful Death

Reaction equation

$$\mathrm{Commensal\_Harmful} \xrightarrow{\mathrm{N\_LP,\ E\_i,\ Commensal\_Harmful,\ N\_LP,\ E\_i,\ Commensal\_Harmful,\ N\_LP,\ E\_i}} \emptyset \tag{90}$$

Reactant

Table 105: Properties of each reactant.

Id	Name	SBO
Commensal_Harmful	Commensal_Harmful	

Modifiers

Table 106: Properties of each modifier.

Id	Name	SBO
N_LP	N_LP	
E_i	E_i	
Commensal_Harmful	Commensal_Harmful	
N_LP	N_LP	
E_i	E_i	
Commensal_Harmful	Commensal_Harmful	
N_LP	N_LP	
E_i	E_i	

Kinetic Law

Derived unit contains undeclared units

$$v_{28} = \mathrm{vol}\,(\mathrm{Lumen}) \cdot \mathrm{Rate\_Law\_for\_Commensal\_Harmful\_Death\_1}\,(\mathrm{K}, [\mathrm{Commensal\_Harmful}], [\mathrm{N\_LP}], \mathrm{A1}, [\mathrm{E\_i}], \mathrm{A2}) \tag{91}$$

$$\mathrm{Rate\_Law\_for\_Commensal\_Harmful\_Death\_1}\,(\mathrm{K}, \mathrm{S}, \mathrm{m1}, \mathrm{A1}, \mathrm{m2}, \mathrm{A2}) = \mathrm{K} \cdot \mathrm{S} \cdot (\mathrm{m1} \cdot \mathrm{A1} + \mathrm{m2} \cdot \mathrm{A2}) \tag{92}$$

$$\mathrm{Rate\_Law\_for\_Commensal\_Harmful\_Death\_1}\,(\mathrm{K}, \mathrm{S}, \mathrm{m1}, \mathrm{A1}, \mathrm{m2}, \mathrm{A2}) = \mathrm{K} \cdot \mathrm{S} \cdot (\mathrm{m1} \cdot \mathrm{A1} + \mathrm{m2} \cdot \mathrm{A2}) \tag{93}$$

Table 107: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
K	K		$2.33225 \cdot 10^{-5}$		☑
A1	A1		0.005		☑
A2	A2		0.180		☑

6.29 Reaction Commensal_Death

This is an irreversible reaction of one reactant forming no product influenced by two modifiers.

Name Commensal Death

Reaction equation

$$\text{Commensal\_Dead} \xrightarrow{\text{Commensal\_Dead, Commensal\_Dead}} \emptyset \tag{94}$$

Reactant

Table 108: Properties of each reactant.

Id	Name	SBO
Commensal_Dead	Commensal_Dead	

Modifiers

Table 109: Properties of each modifier.

Id	Name	SBO
Commensal_Dead	Commensal_Dead	
Commensal_Dead	Commensal_Dead	

Kinetic Law

Derived unit contains undeclared units

$$v_{29} = \text{vol}\,(\text{Lumen}) \cdot \text{k1} \cdot [\text{Commensal\_Dead}] \tag{95}$$

Table 110: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		0.093		☑

6.30 Reaction E_i_Natural_Death

This is an irreversible reaction of one reactant forming one product influenced by two modifiers.

Name E_i Natural Death

Reaction equation

$$\mathrm{E\_i} \xrightarrow{\mathrm{E\_i,\ E\_i}} \mathrm{E\_d} \tag{96}$$

Reactant

Table 111: Properties of each reactant.

Id	Name	SBO
E_i	E_i	

Modifiers

Table 112: Properties of each modifier.

Id	Name	SBO
E_i	E_i	
E_i	E_i	

Product

Table 113: Properties of each product.

Id	Name	SBO
E_d	E_d	

Kinetic Law

Derived unit contains undeclared units

$$v_{30} = \mathrm{vol}\,(\mathrm{Epithelium}) \cdot \mathrm{k1} \cdot [\mathrm{E\_i}] \tag{97}$$

Table 114: Properties of each parameter.

Id	Name	SBO	Value	Unit	Constant
k1	k1		2.5		☑

7 Derived Rate Equations

When interpreted as an ordinary differential equation framework, this model implies the following set of equations for the rates of change of each species.

Identifiers for kinetic laws highlighted in gray cannot be verified to evaluate to units of SBML `substance` per `time`. As a result, some SBML interpreters may not be able to verify the consistency of the units on quantities in the model. Please check if

- parameters without an unit definition are involved or
- volume correction is necessary because the `hasOnlySubstanceUnits` flag may be set to `false` and `spacialDimensions`> 0 for certain species.

7.1 Species `Cdiff`

Name Cdiff

Initial concentration $484\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in 26 reactions (as a reactant in eDC_Production, Cdiff_Death, Cdiff_Growth, tDC_Production and as a product in Cdiff_Growth and as a modifier in Treg_Degradation, eDC_Production, eDC_Production, Cdiff_Death, Cdiff_Death, N_Activation_Migration, N_Activation_Migration, N_Activation_Migration, Cdiff_Growth, Cdiff_Growth, Th17_Plasticity, Th17_Plasticity, Th17_Plasticity, E_Inflame, E_Inflame, E_Inflame, M_Activation, M_Activation, M_Activation, tDC_Production, tDC_Production).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Cdiff} = 2\,v_{11} - v_8 - v_9 - v_{11} - v_{22} \tag{98}$$

7.2 Species `Commensal_Beneficial`

Name Commensal_Beneficial

Initial concentration $1\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in 14 reactions (as a reactant in Commensal_Regrowth and as a modifier in N_Degradation, N_Degradation, N_Degradation, eDC_Production, Cdiff_Growth, Commensal_Regrowth, Commensal_Regrowth, tDC_Production, tDC_Production, tDC_Production, Th1_Differentiation, Th1_Differentiation, Th1_Differentiation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Commensal\_Beneficial} = -v_{20} \tag{99}$$

7.3 Species Commensal_Dead

Name Commensal_Dead

Initial concentration $5 \cdot 10^{10}$ item $\cdot$ dimensionless^{-1}

This species takes part in 14 reactions (as a reactant in Commensal_Death and as a product in Commensal_Regrowth and as a modifier in Th1_Degradation, eDC_Production, Commensal_Regrowth, Commensal_Regrowth, tDC_Production, tDC_Production, tDC_Production, Th1_Differentiation, Th1_Differentiation, Th1_Differentiation, Commensal_Death, Commensal_Death).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Commensal\_Dead} = v_{20} - v_{29} \tag{100}$$

7.4 Species tDC_LP

Name tDC_LP

Initial concentration 0 item $\cdot$ dimensionless^{-1}

This species takes part in four reactions (as a reactant in tDC_Migration and as a product in tDC_Production and as a modifier in tDC_Migration, tDC_Migration).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{tDC\_LP} = v_{22} - v_{23} \tag{101}$$

7.5 Species tDC_MLN

Name tDC_MLN

Initial concentration 0 item $\cdot$ dimensionless^{-1}

This species takes part in seven reactions (as a reactant in tDC_Degradation, Treg_Differentiation and as a product in tDC_Migration and as a modifier in tDC_Degradation, tDC_Degradation, Treg_Differentiation, Treg_Differentiation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{tDC\_MLN} = v_{23} - v_{24} - v_{27} \tag{102}$$

7.6 Species Commensal_Harmful

Name Commensal_Harmful

Initial concentration $1.5 \cdot 10^{10}$ item $\cdot$ dimensionless^{-1}

This species takes part in nine reactions (as a reactant in Commensal_Harmful_Death and as a modifier in Cdiff_Death, Cdiff_Death, Cdiff_Death, Cdiff_Growth, Cdiff_Growth, Cdiff_Growth, Commensal_Harmful_Death, Commensal_Harmful_Death).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Commensal\_Harmful} = -v_{28} \tag{103}$$

7.7 Species N_Lum

Name N_Lum

Initial concentration $0\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in 16 reactions (as a reactant in N_Degradation and as a product in N_Activation_Migration and as a modifier in N_Degradation, N_Degradation, E_Damage, E_Damage, E_Damage, Cdiff_Death, Cdiff_Death, Cdiff_Death, E_i_Damage, E_i_Damage, E_i_Damage, Commensal_Regrowth, Commensal_Regrowth, Commensal_Regrowth).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{N\_Lum} = v_{10} - v_5 \tag{104}$$

7.8 Species E

Name E

Initial concentration $1052500\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in 13 reactions (as a reactant in E_Damage, E_Inflame and as a product in E_Heal and as a modifier in E_Damage, E_Damage, E_Inflame, E_Inflame, tDC_Production, tDC_Production, tDC_Production, Th1_Differentiation, Th1_Differentiation, Th1_Differentiation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{E} = v_{21} - v_6 - v_{16} \tag{105}$$

7.9 Species E_d

Name E_d

Initial concentration $0\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in nine reactions (as a reactant in E_Heal and as a product in E_Damage, E_i_Damage, E_i_Natural_Death and as a modifier in N_Activation_Migration, N_Activation_Migration, N_Activation_Migration, E_Heal, E_Heal).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{E\_d} = v_6 + v_{17} + v_{30} - v_{21} \tag{106}$$

7.10 Species iDC_E

Name iDC_E

Initial concentration $500000\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in two reactions (as a reactant in eDC_Production, tDC_Production), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{iDC\_E} = 0 \tag{107}$$

7.11 Species E_i

Name E_i

Initial concentration $0\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in 19 reactions (as a reactant in E_i_Damage, E_i_Natural_Death and as a product in E_Inflame and as a modifier in Treg_Migration, Th1_Migration, Th17_Migration, E_i_Damage, E_i_Damage, Commensal_Regrowth, Commensal_Regrowth, Commensal_Regrowth, tDC_Production, tDC_Production, tDC_Production, Commensal_Harmful_Death, Commensal_Harmful_Death, Commensal_Harmful_Death, E_i_Natural_Death, E_i_Natural_Death).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{E\_i} = v_{16} - v_{17} - v_{30} \tag{108}$$

7.12 Species M_LP

Name M_LP

Initial concentration $3250\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in 13 reactions (as a reactant in M_Death and as a product in M_Activation and as a modifier in E_Damage, E_Damage, E_Damage, Cdiff_Death, Cdiff_Death, Cdiff_Death, E_i_Damage, E_i_Damage, E_i_Damage, M_Death, M_Death).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{M\_LP} = v_{18} - v_{19} \tag{109}$$

7.13 Species eDC_LP

Name eDC_LP

Initial concentration $0\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in four reactions (as a reactant in eDC_Migration and as a product in eDC_Production and as a modifier in eDC_Migration, eDC_Migration).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{eDC\_LP} = v_{8} - v_{7} \tag{110}$$

7.14 Species M0

Name M0

Initial concentration $1714285.71428571\ \text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in three reactions (as a reactant in M_Activation and as a modifier in M_Activation, M_Activation), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{M0} = 0 \tag{111}$$

7.15 Species N_LP

Name N_LP

Initial concentration 714285.714285714 item · dimensionless^{-1}

This species takes part in six reactions (as a reactant in N_Activation_Migration and as a modifier in N_Activation_Migration, N_Activation_Migration, Commensal_Harmful_Death, Commensal_Harmful_Death, Commensal_Harmful_Death), which do not influence its rate of change because this constant species is on the boundary of the reaction system:

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{N\_LP} = 0 \tag{112}$$

7.16 Species Th17_LP

Name Th17_LP

Initial concentration 0 item · dimensionless^{-1}

This species takes part in 19 reactions (as a reactant in Th17_Degradation, Th17_Plasticity and as a product in Th17_Migration and as a modifier in Th17_Degradation, Th17_Degradation, E_Damage, E_Damage, E_Damage, N_Activation_Migration, N_Activation_Migration, N_Activation_Migration, Th17_Plasticity, Th17_Plasticity, E_i_Damage, E_i_Damage, E_i_Damage, M_Activation, M_Activation, M_Activation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Th17\_LP} = v_{15} - v_3 - v_{14} \tag{113}$$

7.17 Species Th1_LP

Name Th1_LP

Initial concentration 0 item · dimensionless^{-1}

This species takes part in four reactions (as a reactant in Th1_Degradation and as a product in Th1_Migration and as a modifier in Th1_Degradation, Th1_Degradation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{Th1\_LP} = v_{13} - v_4 \tag{114}$$

7.18 Species iTreg_LP

Name iTreg_LP

Initial concentration 0 item · dimensionless^{-1}

This species takes part in 16 reactions (as a reactant in Treg_Degradation and as a product in Treg_Migration, Th17_Plasticity and as a modifier in Treg_Degradation, Treg_Degradation, Th17_Degradation, Th1_Degradation, N_Activation_Migration, N_Activation_Migration, N_Activation_Migration, Th17_Plasticity, Th17_Plasticity, M_Activation, M_Activation, M_Activation, M_Death).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{iTreg\_LP} = v_{12} + v_{14} - v_{1} \tag{115}$$

7.19 Species eDC_MLN

Name eDC_MLN

Initial concentration $0\ \mathrm{item} \cdot \mathrm{dimensionless}^{-1}$

This species takes part in ten reactions (as a reactant in eDC_Degradation, Th17_Differentiation, Th1_Differentiation and as a product in eDC_Migration and as a modifier in eDC_Degradation, eDC_Degradation, Th17_Differentiation, Th17_Differentiation, Th1_Differentiation, Th1_Differentiation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{eDC\_MLN} = v_{7} - v_{2} - v_{25} - v_{26} \tag{116}$$

7.20 Species iTreg_MLN

Name iTreg_MLN

Initial concentration $0\ \mathrm{item} \cdot \mathrm{dimensionless}^{-1}$

This species takes part in six reactions (as a reactant in Treg_Migration and as a product in Treg_Differentiation and as a modifier in eDC_Degradation, Treg_Migration, Treg_Migration, tDC_Degradation).

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{iTreg\_MLN} = v_{27} - v_{12} \tag{117}$$

7.21 Species nT

Name nT

Initial concentration $1.2 \cdot 10^{7}\ \mathrm{item} \cdot \mathrm{dimensionless}^{-1}$

$$\frac{\mathrm{d}}{\mathrm{d}t}\mathrm{nT} = 0 \tag{118}$$

7.22 Species Th17_MLN

Name Th17_MLN

Initial concentration $0\,\text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in four reactions (as a reactant in Th17_Migration and as a product in Th17_Differentiation and as a modifier in Th17_Migration, Th17_Migration).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Th17\_MLN} = v_{25} - v_{15} \tag{119}$$

7.23 Species Th1_MLN

Name Th1_MLN

Initial concentration $0\,\text{item} \cdot \text{dimensionless}^{-1}$

This species takes part in four reactions (as a reactant in Th1_Migration and as a product in Th1_Differentiation and as a modifier in Th1_Migration, Th1_Migration).

$$\frac{\mathrm{d}}{\mathrm{d}t}\text{Th1\_MLN} = v_{26} - v_{13} \tag{120}$$

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